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JUNE 2001

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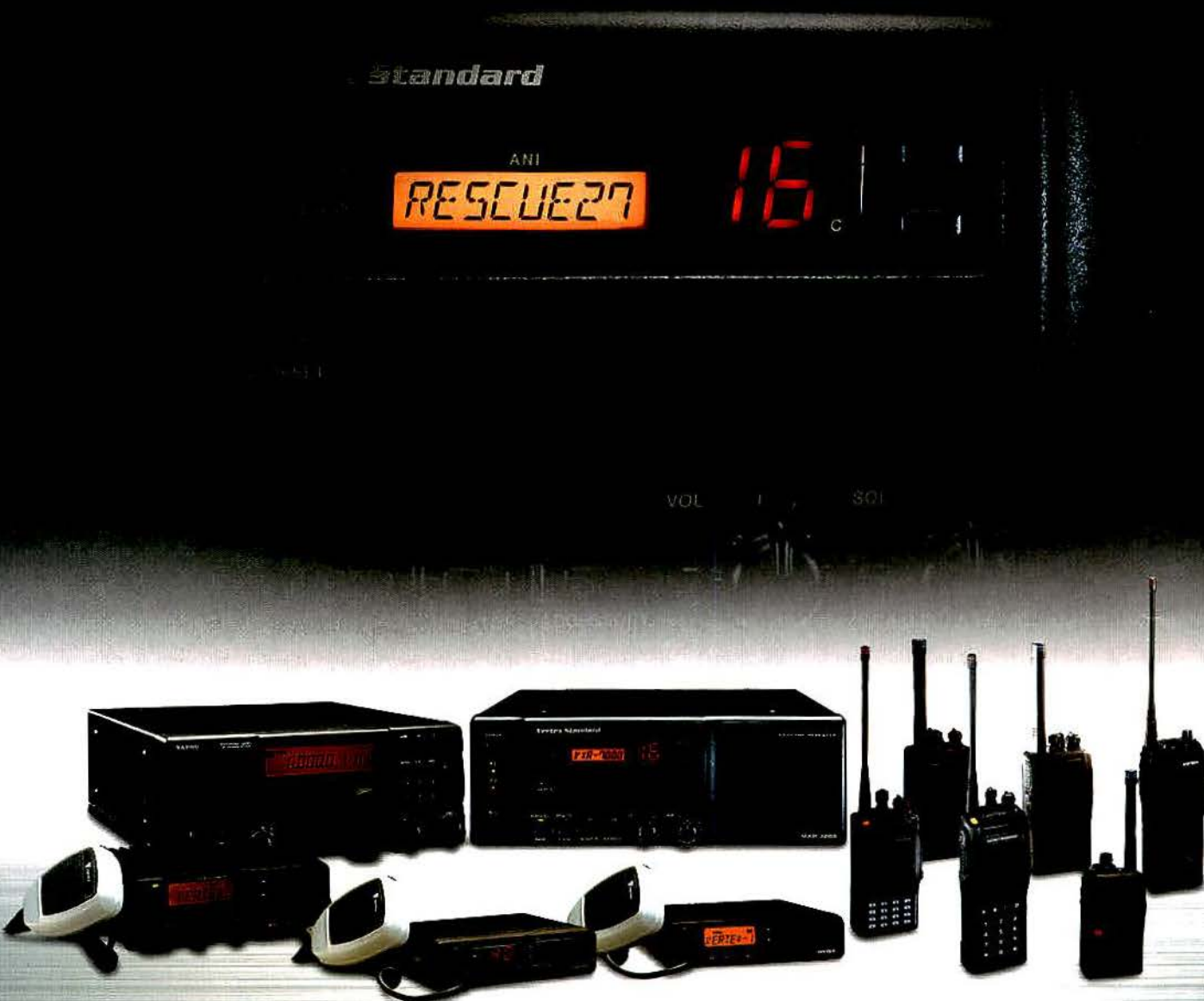
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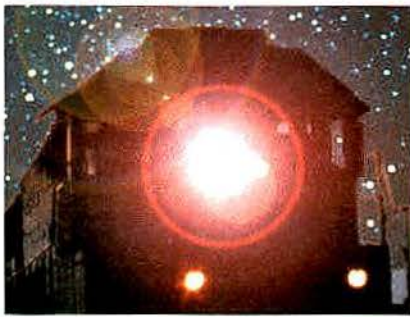
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On the cover: BNSF Railway implements the first comms system that transmits broadband wireless signals using fiber-optics in tunnels. Story on page 34. Photo courtesy of Damian Lydick.

Chugach Electric in Alaska upgrades its radio system to fight tough conditions. See page 40.



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ON WWW.MRTMAG.COM:

Participating in FCC auctions

Kathleen A. Kaercher

Attorney explains the auction process in basic detail, for a complete understanding of how to bid and file paperwork.

Seek professional help

Cleve Watkins, P.E., & Frederick G. Griffin, P.E.

When faced with the non-routine task of upgrading public safety communications systems, owners should look to outside consultants.



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'We still find pleasure in our businesses ...'

I read your excellent and accurate article in February's *MRT* ("POS Perspective," by Bob Urian). I am vice president of the Illinois Mobile Radio Dealers Association, and while we are an organization

of radio dealers, we do little to improve the market position of the small businessman or enhance his (or her) way of doing business. We have dealt with statewide tax issues and had some successes that

benefited all radio dealers in Illinois. We also participated as a group in the SMR-WON organization that fought, unsuccessfully, Nextel's cozy arrangements with the FCC. These were all focused, single-issue fights. We are much like the Indians of the frontier days: We each have our local strengths, but because of fear of showing both cheeks of our rear to the competition, we have never formed meaningful relationships within our industry that deal with broader issues. We are also a fiercely independent bunch, like the Indian. Being in the same room with the competition makes us itch.

At our annual meeting of the IMRDA, president Neal Ragan took a vote on those interested in having seminars on business-related items such as learning PowerPoint for more effective presentations and having demonstrations on new business software for the radio industry. The approval was unanimous, and we are going to have two meetings a year rather than one. This is a small but forward step.

Those of us who hearken from the days of iron men and wooden ships still find joy in hearing the "kerchunk" of a repeater kickback after a new installation. We delight in finding out the range and even hedge it a little by always picking a high spot to key up. Even though the Nextels of the world are scattering towers like rice at a wedding, we still find pleasure in our businesses the big-money boys will never know. Thanks again for your article. Count me in, and keep me posted if you find enough interest to start a national organization.

—Dennis L. Carter
President
Rock River Service
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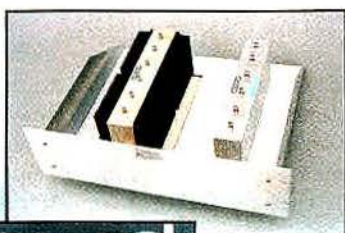
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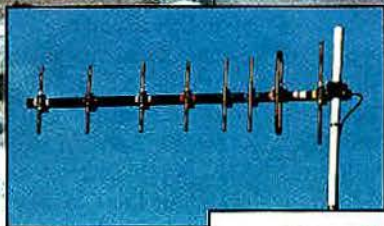
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CIRCLE (6) ON FAST FACT CARD

Want bright lights & noise? Come to Nexteland!

Here's an idea. Let's sell our national parks.

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Plus, the National Park Service would be relieved of the burden of maintaining buildings, roads, trails and other improvements. It could reassign its staff to other, more important jobs than that of park ranger.

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Prudential knows how to run real estate. It knows how to get the "highest and best use" from a piece of property.

Not like the National Park Service. The National Park Service hands out trifling concessions to a few businesses that operate a limited number of

lodges and restaurants on park land. Also, the National Park Service charges a nominal entrance fee that allows just about anyone to use the parks.

And that's a crying shame. Think of what we're missing by not having "Prudentialland" in almost every national park, with rides and entertainment keyed to natural wonders and insurance salesmen dressed in bear suits. To increase attendance at select national parks turned into "Prudentiallands," Prudential could close the rest of them.

The FCC could teach the National Park Service a thing or two. It sells spectrum to plenty of buyers, and the bigger, the better. And when it comes to two-way radio service on the 800MHz and 900MHz bands, no one is bigger than Nextel. It owns thousands of frequencies, some purchased from license-holders and some bought at FCC auctions.

The FCC used to run a "national



park," using its own employees to sell individual licenses, keep order and give many small businesses access to spectrum. Now, the FCC is happy to watch the bright lights, noise and crowds at Nexteland, free from the burden of administering the property it sold. Where Nextel hasn't developed the spectrum it owns, that spectrum is closed to other users.

Prudential makes money, and it advertises its way to a good rep while paying huge settlements for allegedly overcharging or misleading its customers.

Nextel could teach Prudential how to lose money. Whether Nextel overcharges is a matter of opinion, but it charges much more for dispatch service than was charged before the FCC facilitated the sale of spectrum and the construction of Nexteland.

I don't think the public truly benefits financially from spectrum sales. Money paid by carriers

for spectrum is collected from telecom users, and that's most of the population.

As taxpayers, people may get some tiny relief as a result of spectrum sales. As consumers, most of the same people pay it back, maybe several times over.

Perhaps charging consumers seems fair, in a way, because those who use the service pay for it. Yet, if that were the case, why not sell the national parks and let their new owners charge enormous entrance fees to offset the purchase price and development costs? That way, only those who use the parks would be paying for them. Too bad if fewer people could afford to visit and if the park experience became more hype and less nature.

We can't turn back the clock. Spectrum sold is spectrum sold. The FCC continues to issue individual licenses only where frequencies are shared and so crowded that clearing incumbents following an auction might be impossibly expensive. But if you're new to the radio communications business since the auctions, maybe you should know that it didn't have to be this way.

In the 1.4GHz band where the FCC is considering whether to create a new Land Mobile Communications Service, it *still* favors auctions.

As a possible exception, the FCC said that applicants seeking traditional site licensing would be required to demonstrate special needs and a lack of means to acquire spectrum meeting these needs. Maybe there's a glimmer of hope for a tiny national park at 1.4GHz where small businesses could take a place in between Nextelands.

Don Bishop

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[Nextel] charges much more for dispatch service than was charged before the FCC facilitated the sale of spectrum and the construction of Nexteland.



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CIRCLE (7) ON FAST FACT CARD

Who are these guys, anyway?

Regulators go and come. Every few years, a new federal *posse comitatus* is organized in Washington. Like Butch and Sundance, we look down the mountain over our shoulders and wonder aloud, "Who are those guys, anyway?"



Former FCC Chairman William Kennard split in January. Commissioners Susan P. Ness and Harold W. Furchtgott-Roth now leave for greener pastures. Current Chairman Michael

K. Powell has "re-upped" through June 2007. Commissioner Gloria Tristani's term does not end until June 2003, but the buzz is that she will depart early to seek political office in her home state of New Mexico.

Two people do not a commission make, so President Bush has nominated three new posse members. Senate confirmation hearings are pending the FBI's verification that the names aren't in their X-files. The three new office doors to paint are: Kathleen Q. Abernathy, Michael J. Copps and Kevin J. Martin. All have telecom backgrounds; so at least the industry won't have to explain to a former USDA lawyer how radio works.

Abernathy would serve until July 2005. A telecommunications attorney, Abernathy learned the commission's ropes as a legal advisor to past-Commissioner James H. Quello. In private practice, she served as counsel to BroadBand Office, whose management includes past-Commissioner Rachelle Chong. Abernathy was also a vice president for regulatory affairs at U.S. West. Serving as counsel to AirTouch Communications in the mid-1990s, she filed strong comments with the commission regarding access charge reform and interconnection agreements.

Copps would serve until July 2004. Most recently, Copps was assistant secretary of commerce for

trade development. Prior to posts at DOC, he was chief of staff for South Carolina Sen. Ernest "Fritz" Hollings, the ranking democrat on the Senate telecom subcommittee. Copps should know intimate details of the legislative history of the Telecommunications Act. (For all we know, he may have written part of it.) Copps championed Clinton administration causes such as bridging the "Digital Divide" and promoting e-commerce.

Martin would serve until July 2006. Martin, like Abernathy, was once on the commission staff, serving Furchtgott-Roth as a legal advisor. The only obvious "reward-appointee," Martin left the FCC to join the Bush-Cheney election campaign as deputy general counsel. In private practice prior to his FCC work, Martin, a telecommunications attorney, dealt with broadcast ownership, spectrum auctions, microwave relocation, RBOCs, interconnection and universal service.

So, these seem like pleasant, competent people who should work well with the incumbents. Will things change much? Doubtful. The posse has new leaders, but the local sheriffs remain the same. Regulation in Washington is not a top-down process, no matter what the press releases say. Items attracting the commission's attention will be those of interest to the bureau chiefs, office directors and staff. Those offices are the trenches where the communications industry will have to continue to scuffle to get spectrum and technical needs addressed. However, the new faces on the commission should make great speakers at trade association meetings.

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CIRCLE (8) ON FAST FACT CARD

Bustin' a cap on antitrust laws

By Robert H. Schwaninger Jr.

Today, we speak of "caps"—not the type you put on your pickup nor the kind starlets put on their teeth. We aren't talking about the ones that pop in toy guns or the ones that sit on your head. This is about *spectrum caps*—that accessory that keeps the largest carriers warm all winter and in hot pursuit of legislative relief.

At about the time that the FCC was getting ready to auction the wideband PCS spectrum (1997),

competition in the market, it would have to knit a spectrum cap. In essence, the agency said that no one carrier could be licensed for more than 45MHz within a market. Said another way, it "capped" the amount of spectrum a company could have in each market.

That meant that no one carrier would hold two wideband PCS licenses (30 + 30 = a bareheaded violation). It also meant that cellular carriers could become PCS carriers, but not easily, without eating up a whole lot of room under the cap. The largest carriers now do business in a way that is akin to the NBA or the NFL: They pick players (services) they want to bring to each market while still staying under the cap.

When the spectrum cap was announced, the biggest entities didn't kick too much. After all, they were trying to figure out what the heck they were going to do with the 30MHz- and 10MHz-wide licenses they were getting in the PCS auction. That "billions-of-dollars thing" was also involved in paying for the spectrum received. Add that to their technology tussles, build-out requirements, financing efforts, stock sales (with new IPOs just for their wireless businesses), the mega-mergers (and sprinkle in a presidential election) and, well Those big entities were just pretty doggone busy.

But underlying all of this activity was a new energy: the search for the "killer application" that would drive the American public to the wireless revolution like well-heeled lemmings. The savior of the industry would be 3G: the killer technology that would make all of the billions of dollars spent on spectrum purchases and build-outs seem like pennies once the dough started rolling in.

I find 3G to be a mystery. It may stand for third-generation wireless, but the effect it seems to have on

the agency realized that it was auctioning off the widest bandwidth it had attempted to market to date: 30MHz. The FCC, which occasionally has a flash of understanding, decided that for the auction to work and for there to be a semblance of

Schwaninger, *MRT's* regulatory consultant, is the principal in the law firm of Schwaninger & Associates, Washington, which is counsel to Small Business in Telecommunications. Schwaninger is also a member of the Radio Club of America.

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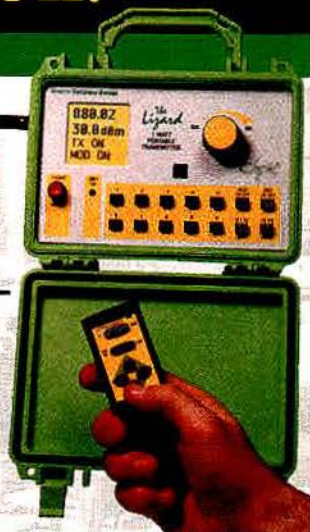


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everything other than the financial markets reminds me more of Y2K. After doing considerable research in this area (which involved actually asking at least four people to specifically define 3G), and after reading a bunch of old magazines and newer textbooks, I discovered that 3G means bundling every known communications service and providing it via the ether.

Telephony, which remains the mainstay of the wireless revolution, would be joined with streaming video, mobile data, AVL and GPS, video conferencing, television, broadcast radio, stock quotes and e- (or m-) commerce. The only thing the device wouldn't do is get rid of your mother-in-law (killer app, my eye).

Still with me? You might notice that 3G involves consolidation of services via a consolidation of spectrum use. Stated another way, it's mega-monopoly building, using technology, rather than economy, as the excuse for creating ever-larger entities to finance the build-out of these dream systems. Either singularly or by consortia, the largest entities would construct systems to combine the offerings of several wireless carriers into one bundled group for marketing to the public.

But this obvious byproduct of 3G musings seems to be getting missed in the discussion. CTIA, and other apologists for the monopolists, declare that America needs 3G, the public demands 3G, and our members want to deliver 3G. Of course they do. It eviscerates every antitrust law known to man in the name of gadgetry.

Those who are technically minded (which would be everyone but me and my dog, Molly) might try to visualize a device to deliver all of these proposed services. You might also try to envision the power requirements of that device. That's right, it's a laptop computer hooked to an AC Delco battery with a back-up solar generator.

But I digress. The dream of 3G and the wonders it might do for the stock of the largest carriers is driving the renewed discussion on spectrum caps. It seems that all of the

services to be delivered in a 3G world cannot be delivered within a mere 45MHz of spectrum. Requirement estimates vary between "100MHz" and "Everybody but us, just get the heck off." So, although in the last four years the FCC has managed to auction, mass-license, and otherwise make available more spectrum than in the previous 63 years, the 3G guys want more—and they want it now.

But there's this 45MHz cap in place, and the biggest carriers are trying to shake it off their heads. They will do it. The current administration is not likely to stand in the way of alleged progress, and Chairman Powell does not have a history of making life hard for the biggest players. He and the new commissioners, in the name of free-market economics, will either lift the cap or eliminate it entirely.

All of this political and economic wrangling is the prelude to the 700MHz auction that keeps getting pushed back. The scheduled migration of analog television to its new digitized spectrum is opening up opportunities for delivering services on vacated broadcast channels. The 3G guys do not want to miss the opportunity to exploit this spectrum just because of some silly cap. The headgear has got to go.

Consider that if the cap stays in place, all of the winners in the PCS auction will be *ineligible* to bid in the 700MHz auction. Now, if you are the federal government's toll-taker, you don't want to leave out the deepest pockets when you "sell" this valuable piece of spectrum real estate. So, there will be a decided advantage to the feds in lifting the cap. They take a bow for promoting free enterprise while making sure that future advanced opportunities are anything but free.

I checked the morning paper and found out that there was a homicide in DC last night. Seems some homey busted a cap on one of his peeps, reducing the competition in his posse and makin' sure that he got his props by this killer app. Word, bro'. Wall Street and 10th Street, S.E., got it goin' on. ■

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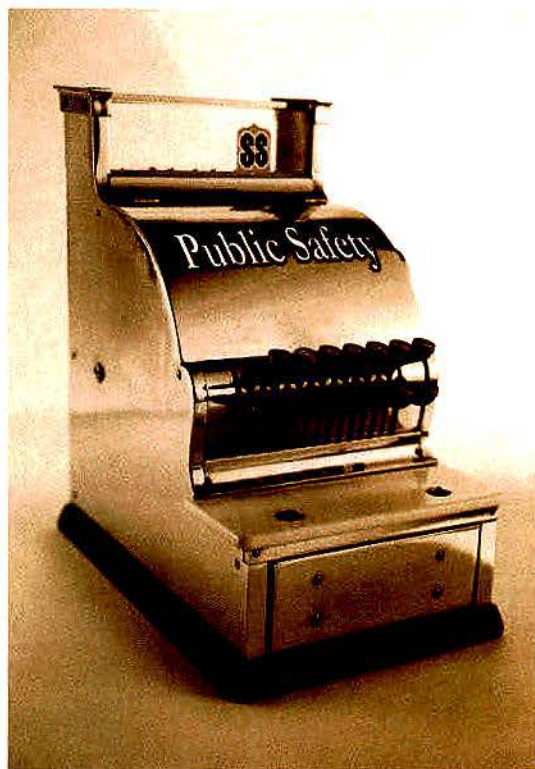
CIRCLE (11) ON FAST FACT CARD

In God we trust

All others pay cash

By David O. Dunford

The above title is an old axiom, humorously employed, but with a kernel of that truth, which is always necessary for effective humor. The problem is that money is tightening up, and yet, some folks still haven't gotten the message.



Technology dollars for public safety have long flowed through a fairly unclogged stream. There have been some brief interruptions, small logjams and minor diversions, but overall, money has been available for the technical support of public safety.

The trouble is, two problems are starting to plague us. First, the

diversity of demands is increasing. More technical ventures cry out, each asking for more money. Second, the technology is no longer comprised of plug-and-play black boxes—it requires continuing staff support.

Large police departments can see as much as 90%+ of their budgets go to human resources. This, combined with the evolving need to "refresh" technology over shorter cycles, leads to a growing demand for dollars.

Remember, government incentive programs were designed, sold and funded with the intent to get/keep/put more FTE (full-time equivalent) police officers on the street. Justification for technology grants was the freeing-up of manpower from clerical tasks to do what is most important for public safety: respond to calls and exercise good judgment.

Where will the money come from, then, as it's unlikely we'll step backward in technology or "un-employ" direct-contact staff? It's actually simple. Public safety will either pay for technology with savings in other line items or create capital projects for procurement.

Let's look at line items first. Is anyone out there buying gasoline cheaper this year than last? Is anyone seeing decreasing costs for natural gas, propane or electricity? (Rhetorical questions, no need to actually reply.)

Well, that leaves telecom expenses and for the curious, I'm sure Bob Schwaninger could probably point out the savings we've all enjoyed in this area since 1996. (As a benevolent act, my friend Grumpy suggests sending spare batteries to your friends in California.) I believe the budget line items are already being well "exercised," so there isn't too much leeway for fiscal expansion here.

Dunford, MRT's public safety consultant, is technical services consultant for the Lenexa, KS, police department. He is a member of the Association of Public-Safety Communications Officials—International. You can email Dunford at mrt@intertec.com.

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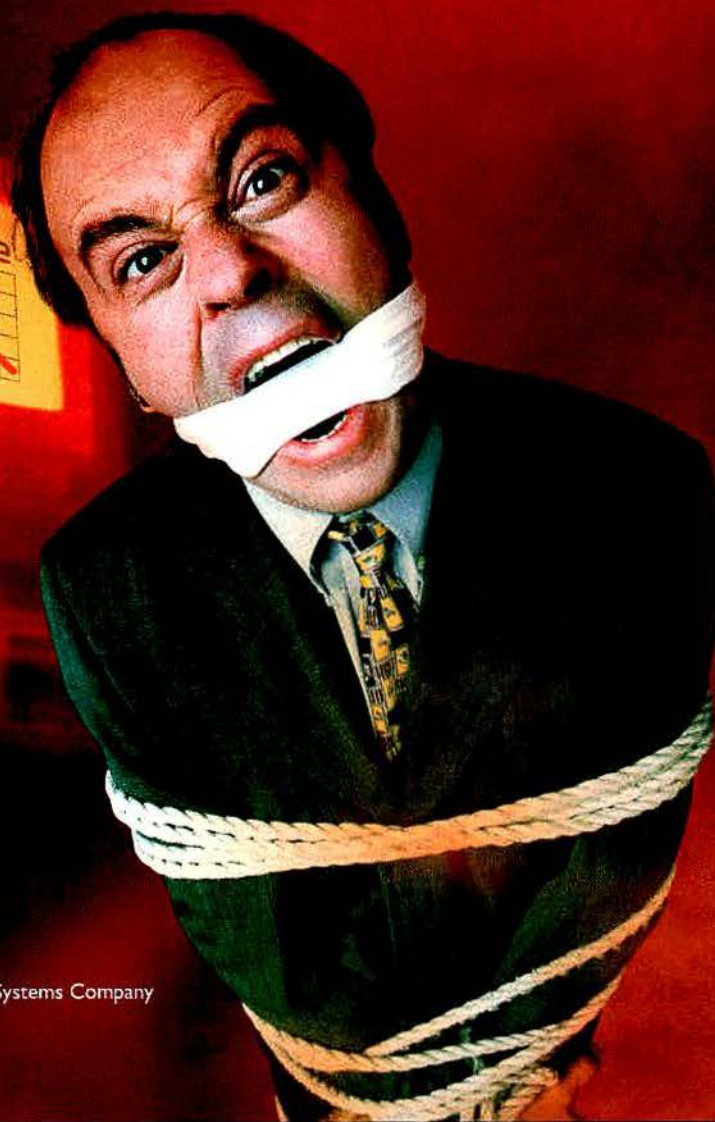
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That leaves capital funding. With public safety relying more heavily on capital purchasing for technology, we are in the unenviable position of financing equipment typically for periods in excess of its functional (or at least its technological) life. Many jurisdictions are approaching the practical limit of their bonded indebtedness (typically for infrastructure procurements such as streets, roads, bridges and buildings or, in the case of taxing districts, for fire apparatus and mandated facility upgrades). That leaves the financial juggler types with the difficult choice of demonstrable public good vs. improved staff efficiency. Does anyone care to project the outcome? Hint: The meeting may be loud, but it won't last too long.

So now that we're "upside down" in our computers, what are we to do? Eureka! We can turn to the Government to bail us out ...

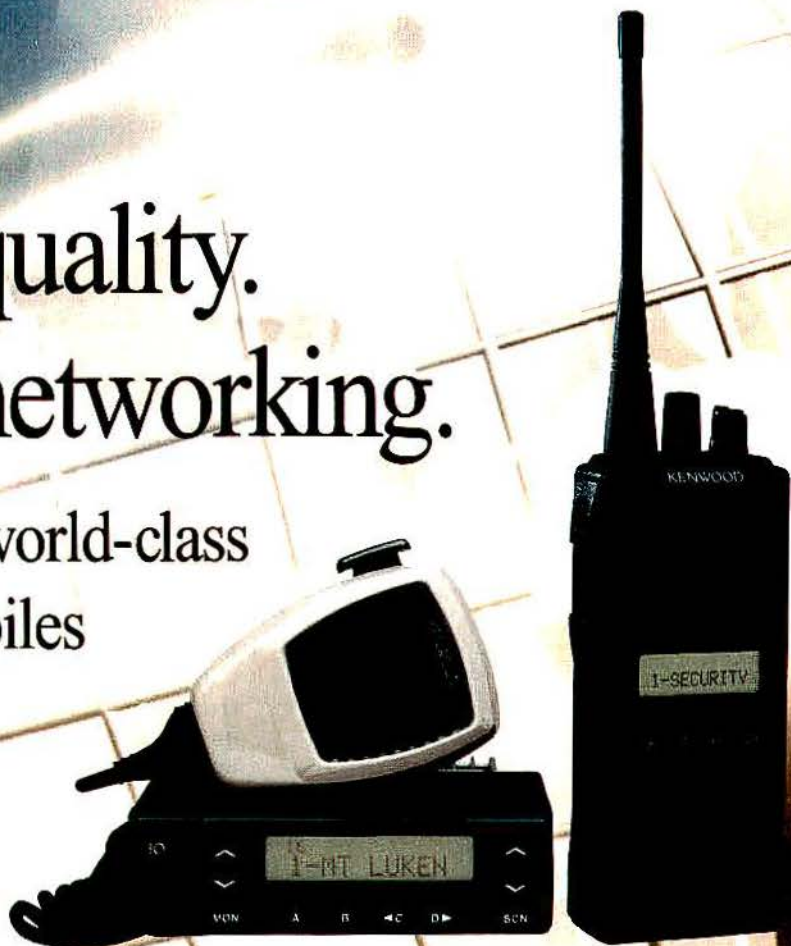
So now that we're "upside down" in our computers, what are we to do? Eureka! We can turn to the Government (with a capital "G") to bail us out and help fund these obviously critical needs. They've helped out police with LEEP and LEAA (that bought thousands of needed radios) in the '60s and '70s and with COPS in the '90s. Well, maybe the Government could establish a blanket program to buy wireless technology for public safety in wholesale proportions, but the real problem is the evolved nature of this "new technology."

Simply, what we "need" now isn't permanent like a Micor base station or durable like a high-powered Mastr II mobile. Our "new technology" is really more like a set of services, not a pallet of equipment, which means that technology has become a budgetary line item and is now similar to any of the other consumable "services" we pay for monthly. ■

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Interoperability 'report card': PSWN grades the progress

An assessment of the nation's progress toward achieving interoperability of public safety wireless systems provides a benchmark for standards and funding.

By Derek Siegle and Rick Murphy

A new "report card" released in May by the Public Safety Wireless Network Program shows that the majority of U.S. states are taking significant steps

communications systems.

This nationwide report card, which is the first of its kind, provides a baseline assessment indicating where the nation's public safety interoperability efforts currently stand. *Interoperability* refers to the ability of public safety employees from one agency to communicate via radio with workers from other agencies, on-demand and in real time.

Using data collected from key public safety employees at the state level, the report card assessed each state's interoperability status in six key areas:

- ☐ shared systems development.
- ☐ coordination and partnerships.
- ☐ funding.
- ☐ spectrum.
- ☐ standards and technology.
- ☐ security.

These six areas were charted individually for each state and then combined to form a composite state interoperability score. Those scores were tiered into four levels of states' readiness: *mature*, *established*, *developing* or *new*. The corresponding map on page 20 shows each state's ranking.

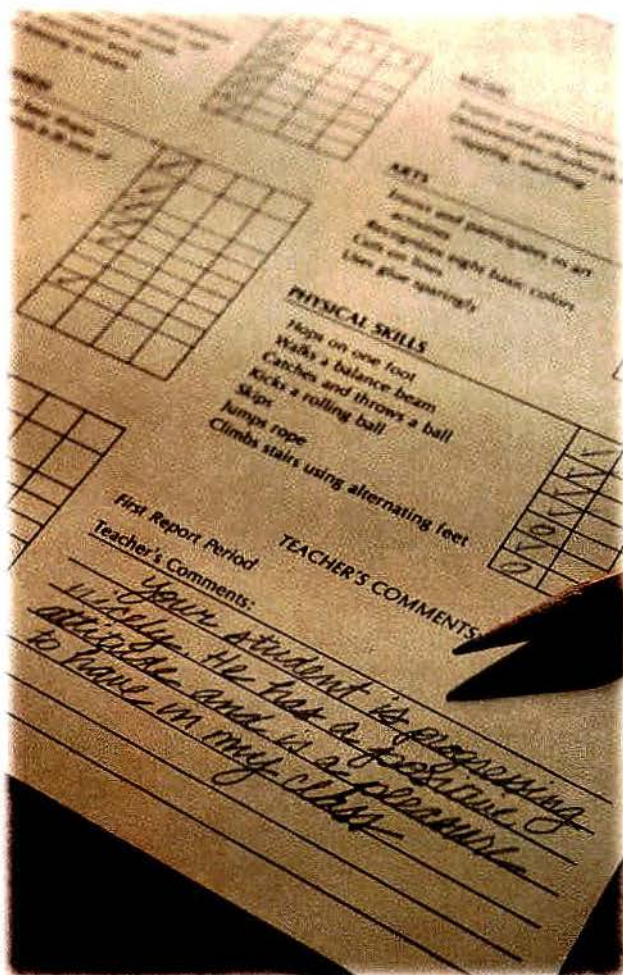
a rating of "mature." *Mature* states have obtained interoperability within their region through the development of statewide systems. These states are actively seeking ways to enhance or to improve their systems' capabilities and possibly to include additional participants.

Established states are advanced in the interoperability process and are implementing interoperable, shared systems. These states have formalized sharing arrangements with multiple levels of government. These states include Colorado, Florida, Iowa, Louisiana, Massachusetts, Minnesota, New York, North Dakota, Utah and Wisconsin.

Developing states are in the early phases of using their acquired knowledge of interoperability. These states are engaging key legislative and public-safety leaders to craft strategic plans for system design and engineering.

States that are relatively *new* to the interoperability process are in the early stages of identifying potential solutions to interoperability issues.

This national report card is a solid first step in assessing where states are in improving interoperability. For instance, Delaware has successfully implemented a



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Delaware and Michigan are leading all states and were given



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SS-25	20	25	2 1/4 x 7 x 9 1/2	4.2
SS-30	25	30	3 1/4 x 7 x 9 1/2	5.0

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SRM-18	15	18	3 1/4 x 19 x 9 1/2	5.0
SRM-25	20	25	3 1/4 x 19 x 9 1/2	6.5
SRM-30	25	30	3 1/4 x 19 x 9 1/2	7.0

WITH SEPARATE VOLT & AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25M	20	25	3 1/4 x 19 x 9 1/2	6.5
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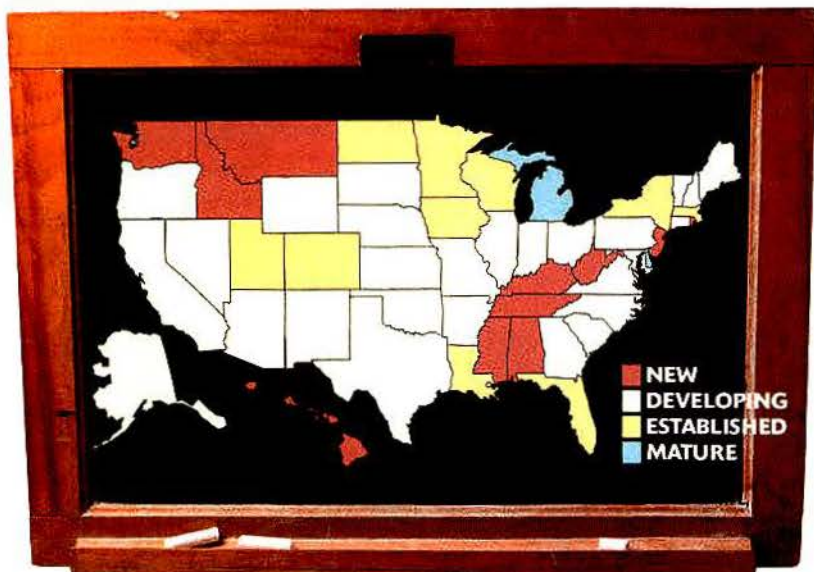
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SS-12RA
SS-18RA
SS-10SMU, SS-12SMU, SS-18SMU
SS-10V, SS-12V, SS-18V



PSWN's assessment of state-by-state interoperability progress. Delaware and Michigan lead the race with a "mature" rating. The two states have obtained interoperability through the development of statewide systems.



digital 800MHz trunked radio communications network. This network provides statewide coverage for more than 7,000 local, state and federal agencies. The system enables emergency responders from all agencies to communicate with each other during an event.

Michigan is also a leading model for public-safety communications. Michigan has successfully implemented a digital 800MHz trunked radio communications network that covers 83 counties and 56,000 square miles. Michigan began replacing its crumbling state-police radio system because police agencies were all operating on different frequencies or equipment, and they often could not talk with one another via radio.

These and other improvements to radio communications systems have enabled certain states to

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achieve true interoperability among public safety agencies. State public safety agencies benefit from having interoperability because a shared system provides greater privacy, better security, improved communications efficiency, better incident management and in-

creased trooper and emergency responder effectiveness.

The PSWN Program will now use the report card's findings and work with individual states on developing technical approaches and policy-oriented solutions to meet their interoperability challenges.

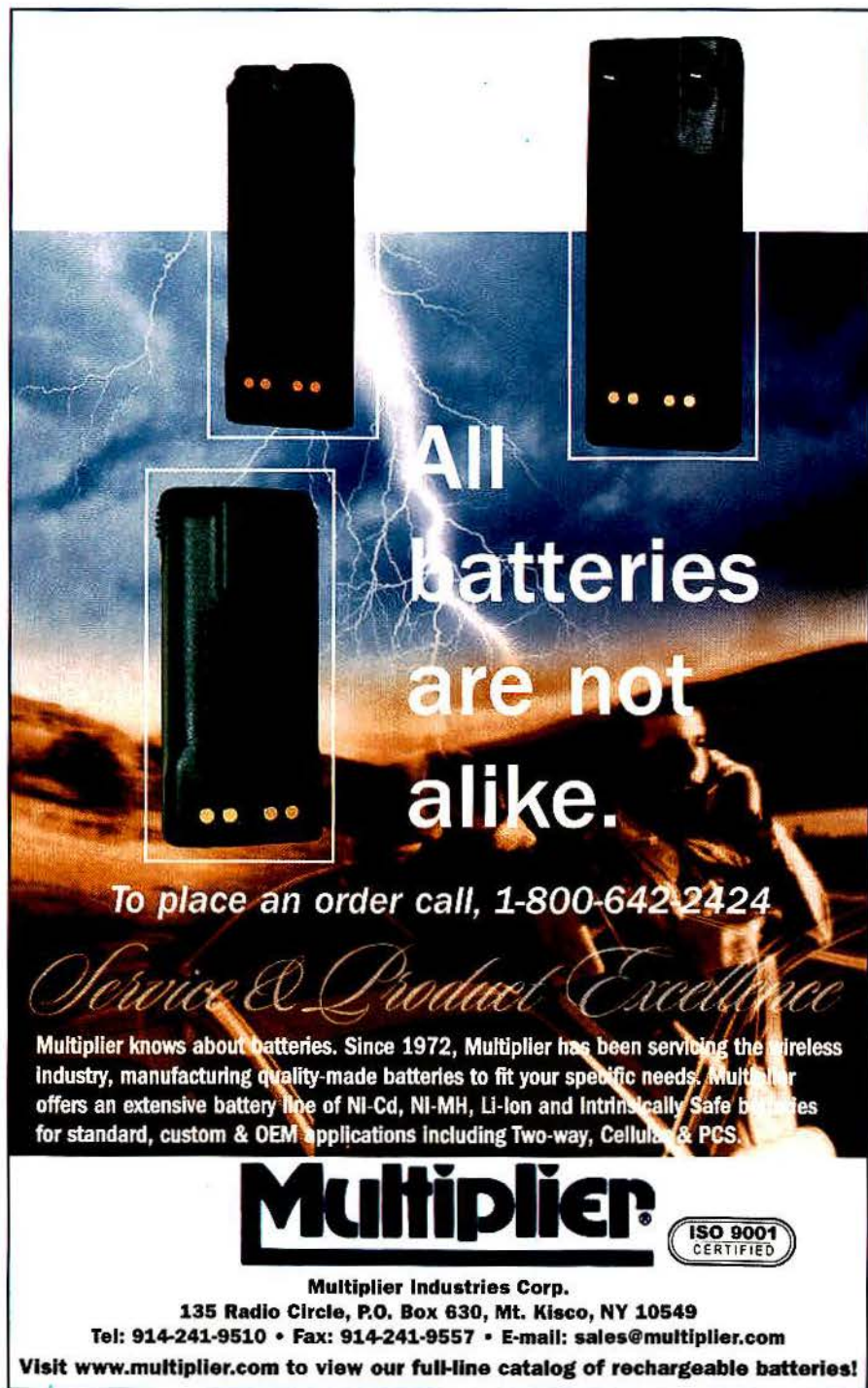
While the results do show states such as Delaware and Michigan leading the charge nationally, the report card is meant to serve as an impetus for policymakers to determine steps that can be taken to advance interoperability on a state-by-state basis.

This report card is just one of the many resources the PSWN Program is providing to the public safety community to help it improve its interoperable systems. The PSWN Program, an initiative that began in 1996, is jointly sponsored by the Department of Justice and the Department of the Treasury. The program works with the public safety community at all levels of government to improve interoperability. The goal of the PSWN Program is to ensure that no man, woman or child loses his or her life because of the inability of public-safety agencies to communicate with one another.

The PSWN Program has taken a two-phased approach to planning and fostering interoperability. Phase I focuses on conducting studies and demonstrating pilot solutions to better understand interoperability challenges. Phase II focuses on providing implementation assistance services to give public-safety agencies sustainable strategies for improving interoperability. Although implementing interoperable systems takes a long time, the PSWN Program strives for incremental progress and widespread interoperability within five to ten years.

Interoperability is key to public safety officials' abilities to perform at the highest levels possible. We ask that the mobile radio community promote the message of interoperability to help make it a reality.

Public safety officials can find out more about their states' ratings and become familiar with the PSWN Program's activities by visiting the PSWN Program's Web site at www.pswn.gov, or by calling 1-800-565-7796 (1-800-565-PSWN). ■



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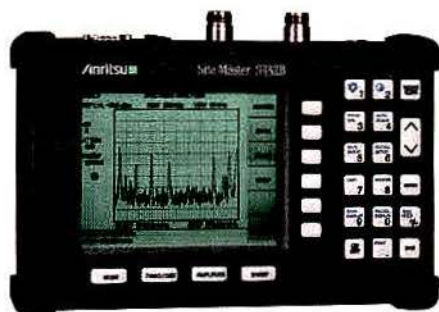
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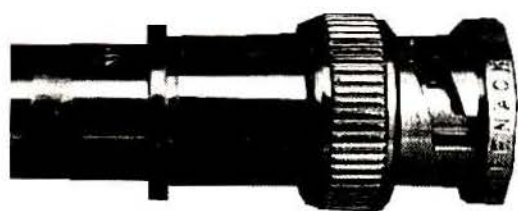
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RF attenuators, terminations, matching pads, loads

By Harold Kinley

The roles of RF attenuators, terminations, matching pads and loads are important in radio communications test and measurement, as well as in equipment interconnection.

A simple RF attenuator is shown in the photo below. This is an "inline" BNC-type attenuator. This particular BNC attenuator is a 50Ω in/out with an attenuation of 3dB, but the attenuators are available in other impedances, connector



This is a 3dB, 50Ω attenuator, BNC style, from Pasternack Enterprises, Irvine, CA.



This is a 50Ω step attenuator. It is useful in many test and measurement procedures and general shop use.

types and attenuation levels. Figure 1 at the right shows the design of a 3dB pi-pad for a 50Ω system impedance. The table at the right shows the various arm- and leg-resistance values for various pi-pad attenuators for a 50Ω system im-

pedance. A 50Ω step attenuator is shown in the photo at the left. Step attenuators generally use pi-pads that can be switched in or out to produce the desired level of attenuation for a temporary test setup or other temporary use.

Figure 2 at the right shows a diagram of a pi-pad or attenuator designed for a system impedance of 50Ω and an attenuation of 20dB. An attenuator pad will smooth out any impedance bumps, and the greater the attenuation of the pad, the greater the degree of immunity to impedance changes. For example, in Figure 2, if port B is left open, the impedance seen "looking" into port B will be 51Ω. If a short is placed between port A and ground, the impedance seen looking into port B will be 49Ω. The SWR in either case is $50 \div 49 = 1.02:1$ or $51 \div 50 = 1.02:1$. If a 50Ω impedance is connected from port A to ground, the impedance seen looking into port B will be 50Ω.

So, from this you can see the impedance-smoothing effect of an attenuator pad. Because this pad has an attenuation of 20dB, it has a pronounced smoothing effect on the impedance. In the example, an open, or short, changed the impedance by 1Ω from what it would have been with a proper 50Ω termination. In cases where the attenuator has a smaller amount of attenuation, the smoothing effect will be less.

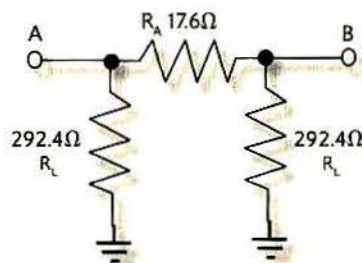


Figure 1. This is a 3dB attenuator pad designed for 50Ω system impedance. The arm and leg resistances are indicated by R_A and R_L , respectively.

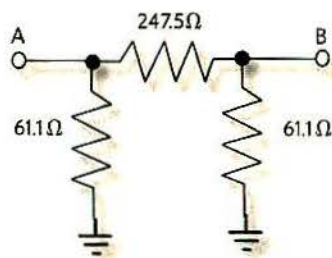


Figure 2. This pi attenuator is designed for 50Ω input/output with a 20dB attenuation. If port A is left open, and an ohmmeter is connected between port B and ground, then the ohmmeter will indicate 51Ω. If a short circuit is placed between port A and ground, then an ohmmeter will indicate 49Ω between port B and ground. If a 50Ω impedance is connected between port A and ground, then a source "looking" into port B will "see" a 50Ω load. This shows the advantage of an attenuator pad. The impedance "bump" is minimized, thus reducing the effect of any load mismatch on the equipment.

Table 1. Arm and leg resistances necessary to make a pi-pad with the given amount of attenuation level shown. This is for a system impedance of 50Ω. The two leg resistors are always equal for a simple attenuator pad.

Attenuation level (dB)	Arm resistor (ohms)	Leg resistors (ohms)
3	17.6	292.4
6	37.4	150.5
10	71.2	96.2
20	247.5	61.1

Contributing editor Kinley, MRT's technical consultant and a certified electronics technician, is regional communications manager, South Carolina Forestry Commission, Spartanburg, SC. He is the author of *Standard Radio Communications Manual, with Instrumentation and Testing Techniques*, which is available for direct purchase. Write to 204 Tanglewylde Drive, Spartanburg, SC 29301. Kinley's email address is hkinley@home.com.



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CIRCLE (22) ON FAST FACT CARD

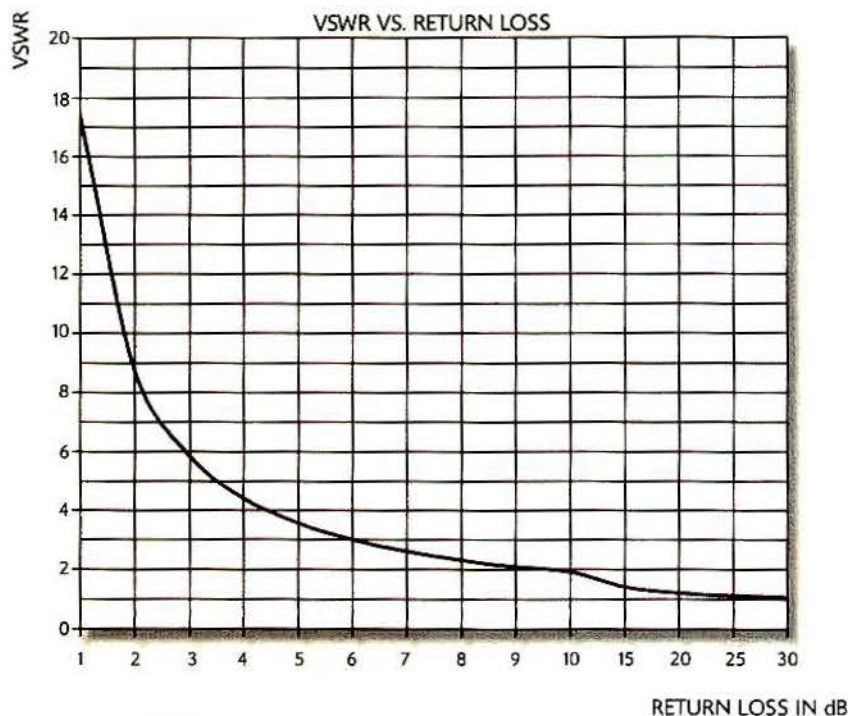


Figure 3. The correlation between SWR and return loss.

The smoothing effect can be described in terms of return loss. The return loss will be equal to twice the attenuation of the pad. For example, in the case of the 20dB attenuator pad, the return loss is 40dB, or twice the attenuation of the pad. This is because the incident signal travels through the pad, and the reflected signal travels back through the pad. So, the *forward-traveling* or incident signal is attenuated by the amount of attenuation of the pad, and then the reflected or *reverse-traveling* signal is attenuated by the amount of attenuation of the pad. So, the effect of the attenuation is doubled.

The graph at the left correlates SWR with return loss. It can be

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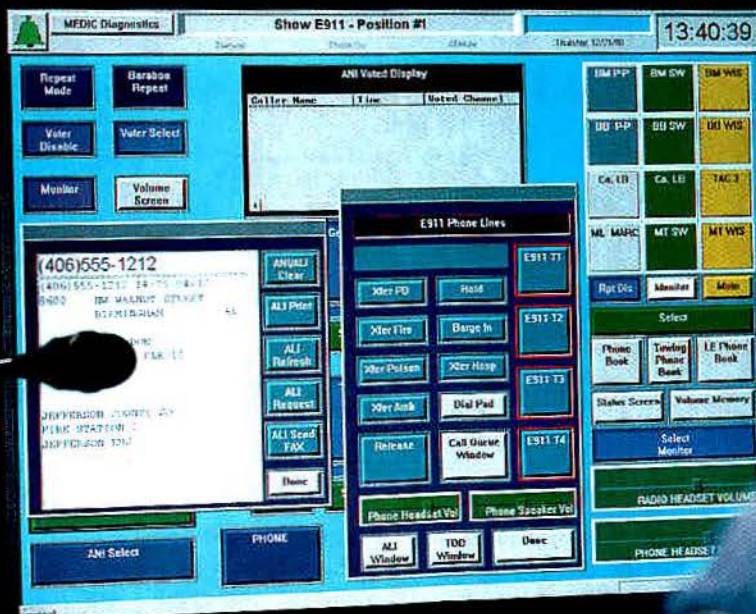
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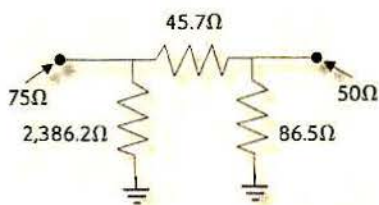


Figure 4. This pi-pad will match a 75Ω impedance to a 50Ω impedance with a loss of 6dB.

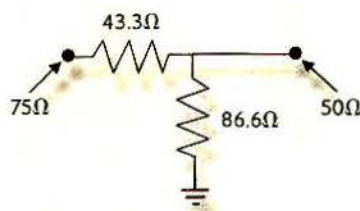


Figure 5. A minimum-loss L-pad used to match a 75Ω impedance to a 50Ω impedance. The loss is 5.7dB.

used to determine the smoothing effect of a pad by doubling the attenuation of the pad and finding this return loss on the graph to convert it to SWR. Suppose we have a worst-case mismatch on one side of a 3dB pad. Because the return loss will be twice this amount, or 6dB, we know from

the graph in Figure 3 that the worst-case mismatch will produce a SWR of 3:1 on the opposite side of the pad. Find 6dB on the return-loss scale, and note that it equates to a SWR of 3:1. Table 1 shows the value of arm and leg resistors used to make pi-pads for the attenuation levels



On the left is a 25W, 50Ω dummy load. On the right is a 50Ω termination.

shown on the chart. Two-leg resistors are used, but they are equal in value for a simple attenuator pad—that is, with equal input/output impedance.

Matching pads

Although simple attenuator



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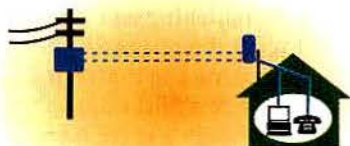
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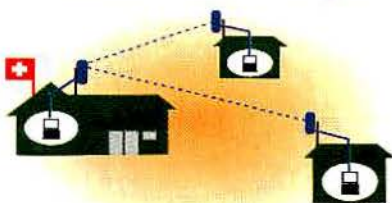
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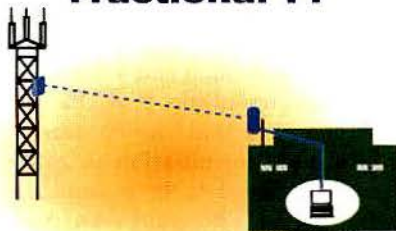
Extends two full-service telephone lines up to 22 km - including wireline-quality V.90 dial-up modem speeds for your Internet connection. Just as if you had standard copper wire telephone service.

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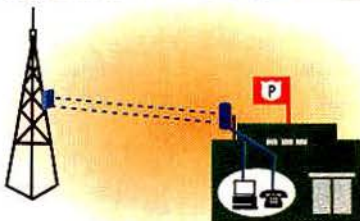
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pads are used where the input/output impedances are equal, the resistive matching pad is used to match two impedances. Such resistive matching pads can be designed for minimum loss or for a loss greater than the minimum loss.

A matching pad can't be designed for less than the minimum loss. For example, to match a 75Ω impedance to a 50Ω impedance, a minimum-loss pad can be used, or one greater than the minimum loss can be used. The minimum loss for

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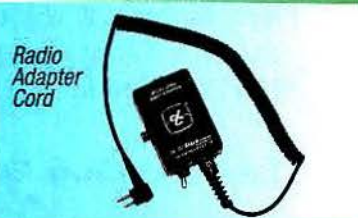
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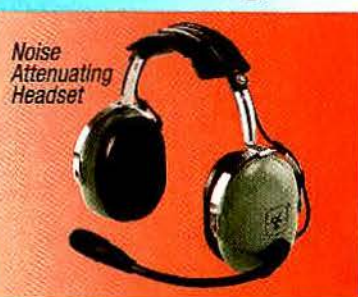
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The Heath 'Cantenna' from the old HeathKit company uses transformer oil (or mineral oil with a derating factor) for cooling.

such a matching pad is 5.7dB.

Figure 4 on page 28 shows a pi-pad designed to match a 75Ω impedance to a 50Ω impedance with a loss of 6dB. Figure 5 on page 28 shows an L-pad that is used to match $50\Omega/75\Omega$ impedances with a minimum loss of 5.7dB. For impedance-matching pi-pads, the leg resistors are not equal, while in simple attenuator pi-pads (where the input and output impedances are equal) the leg resistors are equal.

Terminations

What is the difference between a dummy load and a termination? Fundamentally, it is the amount of power that can be handled. A simple termination is generally considered to be a small-signal device. The photo on page 28 shows a 25Ω dummy load at the left and a termination at the right. While the dummy load could serve as a termination, the smaller termination could not serve in place of the dummy load except at small-signal power levels. Terminations that concern us in land mobile radio work are 50Ω terminations. Terminations are available in 75Ω as well. Terminations are used in such applications as terminating unused ports

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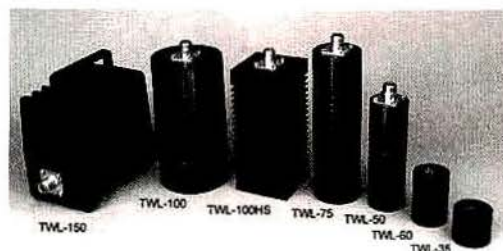
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CIRCLE (28) ON FAST FACT CARD



This 50Ω load resistor is used in the Heath Cantenna.



A variety of dummy loads of various shapes and sizes. Photo courtesy of Telewave, Mountain View, CA.

on signal combiners/dividers and receiver multicouplers.

Dummy loads

Transmitter testing requires that the transmitter be connected to a dummy load to prevent interference to other radios operating on the same frequency. The photo on page 30 shows a dummy load that uses transformer oil to cool the 50Ω load resistor. The resistor element used in this dummy load is shown in the first photo at the left. This load was made by the old HeathKit company and is no longer available. However, a similar load is available from MFJ Enterprises of Starkville, MS. The HeathKit 'Cantenna' also had a built-in detector that could supply a dc voltage that could be used as a power indicator. The unit featured a vent on top of the

can in case of overheating of the transformer oil. The disadvantage of this type of dummy load is that



A 400W, 50Ω 'dry' dummy load, model TWL-400. Photo courtesy of Telewave, Mountain View, CA.

transporting it can become messy if the oil spills. Also, it can only be used in the upright position.

For a portable dummy load, the Telewave 400W dummy load shown in the photo above is a good choice. This is a dry load that is easily transportable and can be used in any position. The large radiating heat sink fins provide rapid cooling of the load. This particular load features a Type N connector.

The second photo at the left shows a variety of dummy loads of different shapes, sizes and uses. When choosing a dummy load, make sure you use one that can handle the full amount of transmitter power without over-heating in a reasonable amount of time. From time to time, check the resistance of the dummy load with an ohmmeter. Frequent overheating of the resistor element can damage the element and cause the resistance to change. Make sure it is close to 50Ω if it is designed for a 50Ω system.

Until next time—stay tuned! ■

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A CANDLE IN T

The combining of RF and fiber-optic technology bodes well to cure railroad communications of 'carpeting tunnel' syndrome.

Photos courtesy of Damian Lydick

THE DARKNESS



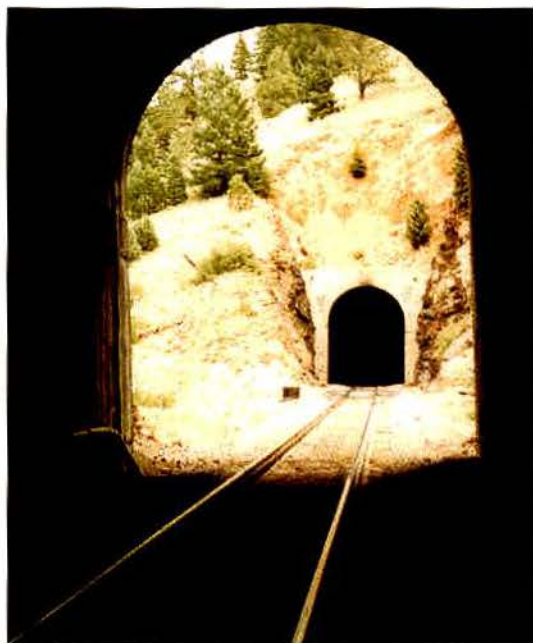
By the *MRT* staff

An old joke says, "The light at the end of the tunnel may be an oncoming train." However, in railroad communications, tunnels are no laughing matter.

Railroad radio systems are vital to train movement and control, switching operations, equipment-failure detection and emergency response. Federal Railroad Administration radio communications rules require the capability to transmit and receive between any location in a railway system and the control center. Not only must trains be in constant contact, but support crews and maintenance vehicles working on any section of track must also be able to call for assistance or receive advisories via radio. (See *MRT* September 1999 and May 2000.)

Trains passing through tunnels briefly lose their critical links to central dispatch in what is obviously a high-risk environment. Communications from one end of the train to the other can also be interrupted. Constant communications between the lead engine and the rear engine is crucial to safe and efficient locomotive operations.

Most railroad tunnels were blasted decades ago when the rail



BNSF's communications system was installed in a 3,318-foot tunnel in Guernsey, WY.

lines were established, long before radio communications was a consideration. Mandatory radio contact can be problematic, even in a short tunnel.

Burlington Northern Santa Fe Railway, at an experimental site in Wyoming, has implemented a solution to this problem. After 11 months of operation, the first communications system designed to transmit broadband wireless signals using fiber-optic technology in tunnels has been deemed a success by BNSF. The system is also applicable to similarly difficult communications environments, such as buildings and subterranean structures.

The system, developed by RF LightLink, Overland Park, KS, was

installed in a 3,318-foot tunnel in Guernsey, WY, in July 2000. The Guernsey BSNF rail yard is near the North Platte River in Eastern Wyoming, about 15 miles from Ft. Laramie. The Guernsey tunnel caused difficulties with the distributive power systems of locomotives passing through it.

Prior to this installation, communicating inside and from the tunnel was impossible. This situation created headaches for trainmasters and roadmasters. The DP system had to be isolated (operator decommissioned) so it would not operate in this area. If the system failed to communicate, the train would probably be stopped. The end unit could no longer receive a signal, and someone would have to go back and restart the unit.

Because the east end of the tunnel feeds directly into the Guernsey rail yard, this is not the best place to have a DP or end-of-train system inoperative. (EOT systems are why trains seldom have the traditional red caboose anymore. The EOT device is radio linked to the locomotive to give the crew systems-status information. Railroads use several frequencies: voice analog FM networks at VHF highband (160MHz, UHF [450MHz-475MHz] for two-way EOT devices and 900MHz for electronic train-control applications.)

The solution to the communications interruption problem was developed under an experimental, nationwide, five-year FCC license granted to RF LightLink's parent company, Prodigy Marketing. Randall W. Crawford, the RF LightLink concept's originator, is pleased with the new application.

"We feel that the system has been in operation long enough now that any problems would have become evident," Crawford said. "We are excited about the opportunities this new application represents to the many businesses that can benefit from this type of service."

BNSF, through its consulting systems engineer, Robert C. Leedham, signed on to be the first to adopt the new technology after

a successful beta test at BNSF facilities in Kansas City, MO.

"Until now, we have had to depend on a 'leaky' coax type of communications system with narrow-band capability, which does not meet our needs in these critical environments," Leedham said. The new system, he said "enables us to address a much wider range of communications frequencies with greater reliability than we could previously with existing solutions at a comparable cost."

The concept behind the new system is the distribution of RF signals from mobile units operating in-tunnel (or in-building) to the outside environment. The system is transparent to the mobile units operating in-tunnel and to the base station and mobile units in the outside environment communicating with the in-tunnel radios. A fiber-optic cable system, connected to a series of "operating nodes," is placed in the tunnel.

At each end of the tunnel is a "donor node" that receives signals from outside the tunnel. The donor node converts RF energy into light energy that can be transmitted throughout the tunnel via the fiber-optic cable and the series of operating nodes. These nodes, spaced about 1,000 feet apart, function as transceivers, converting and transmitting signals received by the donor node to the tunnel environment. They also convert and transmit signals from the mobile units operating in the tunnel to broadband antennas located at the tunnel entrances. The RF energy is transmitted from the broadband antenna into the open environment with no change in power, frequency, bandwidth or modulation.

The broadband antennas for the Guernsey demonstration project were placed at a HAAT of about 45 feet. Although they can cover 100MHz to 1GHz, the antennas are being used in this application for 160MHz and 460MHz systems.

The RF LightLink system is designed to receive and transmit frequencies for virtually all forms of

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wireless communications, including cellphones, pagers, trunking, digital and more. The units are protocol-independent, meaning that regardless of the frequency band or modulation scheme used in the outside environment, "send"

and "receive" modes will operate the same way inside the tunnel or subsurface area.

BNSF's tests showed the system to be highly efficient. "In tests of bit-error rates on the RF LightLink system, more than 10,000 different

strings of 100,000 characters each were sent and received with zero errors," Leedham said.

Leedham handpicked a team of 28 technicians to conduct the installation. This team of specialists, led by Project Manager Mark Wentland and Project Leader Ray Southworth, included telecom tower foremen, telecom tower men and electronics technicians. The installers worked diligently as a team without injury or mishap. This is notable because they also had to work *fast*—in two- to four-hour intervals between train operations. Still, the installation was completed in seven days, with an additional three days for tweaking the system.

Modified railcars were used as work platforms to help the installers to run cable and to set up multiple transmitter locations. Specially designed stainless-steel clips were used to simplify installment of the cable systems. A temporary lighting system, supported by a 35kW generator, was also required.

Once the hardware was installed, the next step was to run cable, 48Vdc cable first and then the fiber-optic cable. Three fiber-optic cable transceivers were then placed in the tunnel. These units receive RF signals off air, modulate them onto fiber-optic cable and then route the signals to all units inside and outside of the tunnel. Fiber-optic cable takes a mere 3ns to send a signal 1km, and demodulating the RF takes only 500µs.

The antennas were installed at the same height as the antennas mounted on the train. This promotes more signals getting to the antennas. There are two antennas per transceiver. Keeping the TX and RX separate allows faster transmission and signal reconstruction. If a transmission is received by a transceiver (node) in the tunnel, the signal is sent to all nodes and through the fiber-optic cable, and the units transmit all at the same time.

The east-end site had yagi antennas pointing directly into the

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CIRCLE (32) ON FAST FACT CARD

rail yard. This allowed communications from inside of the tunnel with portables or mobiles. This was not available before the system was installed. In fact, 30W mobiles would not talk inside the tunnel before the new system was installed. Once the installation was completed, a 5W portable could talk to the yardmaster from anywhere inside of the tunnel or at the openings of the tunnel. Yagi antennas were also placed at the west-end site to provide communications to the outside world from inside the tunnel, or vice versa.

The system is alarmed at each location, sending back alarm status to the central unit. The alarm circuit will sense power levels and create an alarm condition if the levels fall below the programmed minimum. The system is constantly monitoring the RF, fiber-optic and power inputs for possible faults. If power is dropped for whatever reason, the unit automatically switches to battery backup. The battery backup lasts as long as three days. In addition, when an alarm condition is sensed, a blue-flashing strobe activates at the individual node.

The entire system will continue to operate, even if one transceiver is inoperative. The fiber is sent from unit to unit in daisy-chain fashion so that any one unit can be taken out of the system and the entire

Trains passing through tunnels briefly lose their critical links to central dispatch.



system won't be compromised.

"With RF LightLink, we strive to have a system that is balanced and use placement of transceivers in areas needed—*pristine placement*, not using brute force or high power," Crawford said. "Fiber-optic losses are in the 0.23dB arena, *per*

kilometer. Essentially, anything transmitted can be received and modulated onto fiber-optic and then retransmitted as an RF signal into an area of desired coverage." RF LightLink submitted a patent application for the system in December of 1999. ■

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ELECTRIFYING THE NORTHLAND

Alaska's largest power provider searches for ways to upgrade its radio communications to keep up with the many challenges of a harsh environment.

By Donald E. Koehler

Chugach Electric Association is the largest power supplier in Alaska. CEA's headquarters is located in Anchorage, AK, and its service area covers the majority of the state's population. The association operates power plants, distribution lines and substations, providing retail and wholesale

electric and energy services.

Providing these services requires radio equipment that can deal with some of the toughest conditions found anywhere on the planet. In addition to the high voltage, snow and ice you might expect, throw in hurricane-force winds on a regular basis,

earthquakes, volcanic ashfall and flesh-freezing cold. Then

Contributing Editor Koehler is a network operations manager at a major Alaskan communications corporation. His email address is AFDEK1@uaa.alaska.edu. The author would like to thank CEA's Vance Cordell and Russell Thornton for the time spent answering questions on a busy day.

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add in occasional encounters with brown bears, and you will begin to see why operations, dispatch and maintenance crews place a premium on solid, reliable

wireline communications.

When I asked if cellular telephones were a part of CEA's regular communications, Cordell and Thornton were quick to point out

some important operational obstacles. CEA does use a limited number of cellphones for administrative traffic, but for safety reasons it does not permit cellphone use for operations.

When crews are maintaining the energy distribution infrastructure or performing response, recovery or restoration activities, their safety has to be "Job Number One." The use of the LMR system permits multiple crews to monitor, to communicate, to direct and to respond across a single channel. While this is possible with cellphones, it is certainly not as simple as a direct communications system.

Another factor that may be overlooked is durability. The Motorola MX-series hand-holds that CEA uses in the field are mounted in fleet vehicles. Because of the nature of utility work, there is scarcely any cab location not subject to a lot of abuse.

Common cellular equipment would be hard-pressed to take the kind of knocks dished out by a hard-working line crew—and survive. These radios, which can be removed from the vehicle, strapped to a belt and used with

a hand mic, represent a solid, all-weather communications system. The radio is critical for protecting the lives of line crews as they work in remote or isolated areas.

Some utilities eschew operating a private radio in favor of leasing or purchasing time on an SMR system. Both Cordell and Thornton agreed that leasing equipment and airtime from an SMR operator represents a value that should be reviewed—if the system meets the service coverage requirement. When asked why they rejected the idea for CEA use, their answer was no surprise: control and reliability. These radio managers hold a conviction that a cellular-architecture system would overload in a crisis situation, such as a power outage. Systems can rapidly jam up as users call to check on the condition of friends and family. An SMR might suffer the same fate, even if priority service levels had been established. CEA's public responsibility simply outweighed any potential cost savings, Cordell and Thornton said.

CEA's microwave backbone system is used for SCADA links, as you might expect, and it is used to tie together the extensive LMR network. The association is looking at the potential for creating supplemental revenue by leasing surplus bandwidth. (A sharp paging or SMR system owner would quickly see the value of site hosting by an electric utility.)

Collocation, site hosting and sale of excess control bandwidth by a utility can be viewed as either a threat or a boon, depending on the type of system you operate.

CEA operates an almost all-Motorola UHF network, with a few Kenwood hand-holds of recent vintage rounding out the inventory. I asked the obvious question about a trunking upgrade and was informed that a request for proposal had just been released.

How the RFP is worded may be of interest to system operators. Because CEA does not want to replace a well-working system, the RFP



Even conventional LMR dispatch systems are dependent on computers, as shown by the Chugach dispatch console.



Robert Strong, a long-time lineman with Chugach, shows how much smaller and lighter his new hand-held is when compared to the equipment he used when he first started work at the association.

communications.

In May I interviewed CEA Communications Manager Vance Cordell and CEA RF and Wideband Engineer Russell Thornton, P.E. The discussion revealed some insights that may interest operators of other utility radio systems.

First, the system supporting CEA's operations is a conventional LMR repeater system with 15 repeater/remote base stations, 142 mobiles and 114 hand-held units. The system is tied together by a combination of private microwave, radio links and leased



Built to last, this Motorola MX UHF hand-held is more than up to the knocks and weather conditions encountered by this 'mobile office.'

was written with open specifications as to trunking type. The goal is for the proposed solution to maximize existing repeater systems.

The RFP also focuses on a phased conversion to a 450MHz trunked system, extending the service life of existing equipment. Licensing issues have been sorted out with the FCC in advance, allowing

vendors to concentrate on system components and installation timelines without sweating license issues. Another consideration for the trunking system was the potential for selling and leasing excess capacity to electrical contractors who deal with CEA on a regular basis.

When I asked about disaster preparations, CEA's answer was a bit of a surprise. When bad weather or any anticipated problem is on the horizon, boxes of extra, charged batteries are delivered to operations from the maintenance department. It seems that extended operations chew up portable batteries at an almost unbelievable rate.

CEA uses OEM batteries, and it has a limited rotation/rehabilitation program for its current inventory. All radios are programmed for talk-around, and all system components have regular maintenance for maximum availability. You might say emergencies are pretty routine for the CEA network.

System operators should note the emphasis on reliability and durability these managers place on their system and components. The requirements to phase-in any new system and to maximize existing

system elements are key factors in the recently released RFP. The advance work by CEA management on licenses and leaving the trunking architecture choice open to vendors struck me as a bit out of the ordinary in a

utility system bid process. These factors point to careful planning and a sharp eye on the bottom line.

CEA has an excellent record for electrifying the Northland. These folks are proud of their system and it shows. ■

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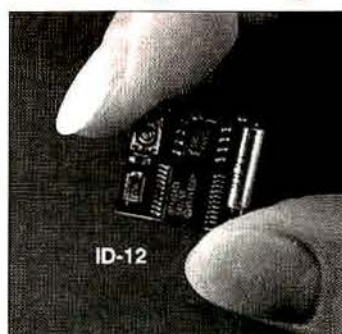
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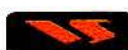
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Project 25 scanner expected in 'about a year'

Uniden America, Fort Worth, TX, expects to manufacture a scanner capable of receiving trunked Project 25 communications within a year or a little longer.

"It's something we have been working on," said Jim Cassidy, the company's product planning manager in charge of scanners and other products.

Cassidy said that listening to communications carried by a public safety trunked radio system doesn't violate restrictions imposed by federal law, which includes exceptions for public safety

communications and for broadcasts intended for public reception.

Aside from many other advantages offered by trunking,

some public safety agencies liked the relative privacy offered by trunking before trunk tracking scanners were developed. Conventional scanners cannot automatically follow

conversations or working groups as they switch from channel to channel. But news-gathering organizations pressured local and state governments to allow them to purchase trunking transceivers—with the transmitters disabled—to continue monitoring police, fire and emergency medical communications.

Many public safety agencies relish the thought that Project 25's digital signals once again will give them privacy because current scanners only convert analog signals into intelligible audio. Development of a compatible scanner would overcome the nominal privacy given by Project 25's digital nature.

The next step for public safety agencies would be to use Project 25's encrypted mode.

"Once a system is encrypted, it is absolutely illegal to monitor it," Cassidy said. "But when enough systems go encrypted, news agencies will bring it to the FCC's attention and say, 'We can't deliver the six o'clock news anymore because we can't hear what's going on.' What

will drive that to occur is when we release a Project 25 digital scanner."

Cassidy said that although it is uncertain whether the FCC would act, it seems certain that news agencies will make a case that they have the right to monitor communications systems paid for by taxpayers. He expects news organizations to concede that certain facets of public safety communications should be encrypted, though.

"I have a feeling that's where the argument will be played out, but not for a couple of years," he said. "When Uniden produces a Project 25 scanner, many news agencies will need one because many systems are going to Project 25 so quickly. Will public safety agencies choose to spend the money to go encrypted? If they do, all that can be done is to bring it to the FCC's attention that news agencies will be unable to hear common transmissions that allow them to bring citizens the news.

"The first step toward that day will be taken when Uniden comes to market with a digital scanner," Cassidy said. —D.B.



Uniden's BC780XLT trunk tracking scanner

JPS Communications completes new facility

JPS Communications, Raleigh, NC, has completed its new 16,212-square-foot office complex. The new facility, located at 5800 Departure Drive in Raleigh, will house the company's engineering, marketing and manufacturing departments.

JPS Communications designs, manufactures and sells electronic

hardware and software products that enhance communications systems.

The company's present focus is radio interconnect products, such as the ACU-1000, which facilitates communications between HF, VHF/UHF, 800MHz trunked and various other media, such as cellular, land-line telephone and satcom.

M/A-Com to provide IP network to Florida

Lowell, MA-based M/A-COM, a division of Tyco Electronics, has been selected by Florida's Municipal Public Safety Communications Consortium of Palm Beach County, FL, to provide its Open-sky wireless IP network for public safety communications.

The system will be deployed in as many as 30 municipalities in

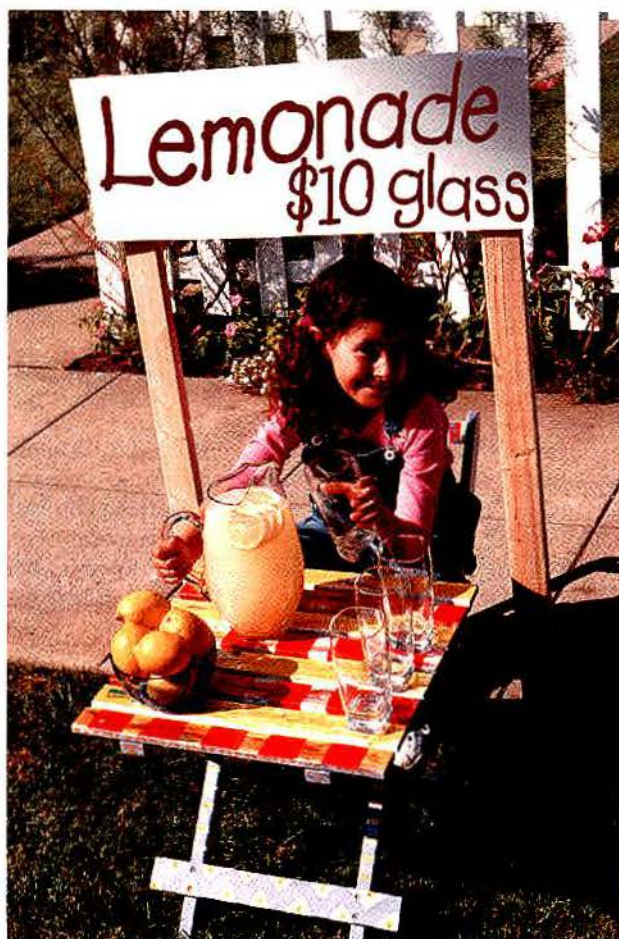
Palm Beach County. The agreement, which includes two phases spanning the next 18 months, calls for M/A-COM to provide infrastructure equipment, subscriber equipment and implementation services for a countywide, digital voice and data wireless network. Phase I of the contract will be about \$8 million.

Scanning ...

The Cambridge Group, Suwanee, GA, has been hired as a manufacturer's representative for **Kenwood Communications**, Long Beach, CA, and **iTech**, San Diego. The company will represent the Texas, Oklahoma, Arkansas and Louisiana territory. iTech has also hired **W. A. Hendrickson Company** as its rep for the Vermont, Connecticut, Massachusetts, New Hampshire, Rhode Island and Maine territory.

AC Data Systems, Post Falls, ID, will market and sell Harrisburg, PA-based **Tyco Electronics'** Strikesorb suppressor modules.

TESSCO Technologies, Hunt Valley, MD, has formed an alliance with Kansas City, MO-based **Black & Veatch Telecommunications**. Black & Veatch will be recognized as a TESSCO implementation and deployment alliance partner for its broadband products.



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Software supports Kenwood system

IDA's Fleetsync Kencall for use with Kenwood Communications' Fleetsync radio systems is designed to assist dispatchers in management of voice communications and text messaging. Features include digital radio ANI, selective calling, inter-fleet calling, text messaging and remote "stun" control of radios.



This system also allows serial interface to personal computers.

WWW.IDA.COM

System features easy access

TriTech Software Systems' Visicad Webview supplies the user with an administrative view of dispatch operations. This system allows users to easily access incidents and demographic data from remote locations. By using the Microsoft Internet Explorer browser, the user can review current and historical activities for units and incidents in either text or graphic formats.

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Software combines dispatch, 9-1-1

The Ultracom 2000 9-1-1 radio dispatch console system from Moducom combines radio dispatch and 9-1-1 in a single software application. Add the hardware for either one to existing

hardware. This all-digital, 32-bit Windows 2000 NT system is 100% user-programmable with built-in diagnostics. The radio dispatch component has dual, built-in instant recall recorders. The 9-1-1 component features pop-up ANI/ALI windows and seamless CAD interface. Software upgrades are free.

WWW.MODUCOM.COM

Combining controls conserves space

Zetron's Integrator suite includes Integrator 9-1-1 for call-taking and Integrator RD for radio dispatch. By combining all controls on one or two video displays with a common keyboard and mouse, this product conserves valuable desktop space. All the elements of this system use common screens, simplifying dispatcher training.

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Decoder displays emergency status

The CAD-500 from Midian Electronics is compatible with Motorola's MDC-1200 signaling format. The CAD-500 decodes lead-



ing, trailing and emergency ANI. The decoder displays the unit ID, the alias, the time and date information and the emergency status on the computer's monitor. The ANI-M with MDC-1200 ANI is compatible with the CAD-500 and allows most any radio to be fitted with MDC-1200 signaling.

800-MIDIANS OR WWW.MIDIANS.COM

Consoles offer flexibility

Orbacom Systems offers communications consoles that include 9-1-1, CAD, mapping and radio dispatch at a single position. The TDM 25, TDM 150 and the T5 are specifically designed for different console needs. TDM-25 serves small- to mid-size centers, and the TDM-150 works for mid- to large-size centers.



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EML	60	103	615-771-2560	Telepath	62	111	510-656-5600
Gamber Johnson	51	41	715-344-3482	Telewave Inc.	5	6	650-968-4400
Gentex Corp.	20	18		Thunder Eagle	45	38	703-242-0122
ICOM America	21	19	206-450-6041	TX RX	3	4	716-549-4700
IDA Corporation	45	37	701-280-1122	Vega/Telex Signaling	4	5	402-467-5321
Industrial Communications ..	63	115	617-837-7000	VERTEX/YAESU USA	IFC	1	310-404-2700
Iridium	7	7	866-947-4348	WETEC	62	110	901-286-6275
I-Tech	26	23	619-458-1500	Zetron	31	28	425-820-6363
JEI Recorders	52	42	888-677-2844				

Mobile Radio Technology (ISSN 0745-7626) is published monthly by Intertec Publishing, 9800 Metcalf Ave., Overland Park, KS 66212-2215, and is mailed for free to qualified subscribers within the United States and Canada. Periodicals postage paid at Shawnee Mission, KS, and additional mailing offices. Canada Post Publications Mail (Canadian Distribution) Sales Agreement No. 0956309.

POSTMASTER: Send address changes to *Mobile Radio Technology*, P.O. Box 12960, Overland Park, KS 66282-2960.

SUBSCRIPTIONS: Non-qualified subscribers may subscribe at the following rates: United States: one-year: \$35; Canada: one-year: \$45. Qualified and non-qualified subscribers in all other countries: one-year: \$45 (surface mail); \$90 (air mail). Subscription information: P.O. Box 12960, Overland Park, KS, 66282-2960.

Systems service rechargeable batteries

The battery management systems from **Christie Electric** service rechargeable batteries. These products include the ProEase Universal 60 and the RF80-K. The RF80-K features automatic operation, reflex charging, digiflex analysis, cell-voltage balance testing and constant current and potential charging. Additional features include one-hour charge/discharge for NiCd batteries and advanced reconditioning capabilities, also for NiCd batteries. The Universal 60 offers digital current settings, self-calibration and easy-to-use settings and indicators.

WWW.MPTC.COM

Product Encore

Of the new products in the October 2000 issue, this one generated the biggest reader response. For more information on this product, log on to www.antenex.com.

Antenna features low visibility

The Phantom GPS/UHF dual-band antenna from **Antenex** features low visibility, wide bandwidth and a low-angle radiation pattern. The GPS mounted inside the ABS-molded housing with the antenna features an active 27dB LNA. The housing fits into a standard 3/4" hole and mounts with the supplied locking washer and bolts. RG58 cable is supplied with the UHF antenna, and RG174 supplied for the GPS. The whipless design allows car washes without removing the antenna. The antenna also features field diversity, offering simultaneous sensitivity to electric and magnetic fields.

WWW.ANTENEX.COM



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CIRCLE (39) ON FAST FACT CARD

Antennas mount on rooftops

The Telelocator dual-system antennas from **Antenna Specialists** combine active GPS location identification with broadband cellular for complete frequency coverage without tuning. The GPS engine includes a weatherproof ultrasonic seal to protect against extreme weather conditions. A single-cellular/GPS antenna is suitable for service providers who have added GPS positioning to existing cellular services.

WWW.ANTENNA.COM



Software supports public safety

Aegis Field Reporting from **New World Systems** is designed for public safety. This technology improves officer productivity and safety by creating reports that meet agency, state and IBR standards so the report only needs to be written once. This software is fully integrated with the company's public safety suite of software including CAD, Law Enforcement Records and Mobile Computing. Officers write reports based on information already entered into the system from dispatchers and from the officer's notes taken at the scene. The field reporting module automatically populates the fields that have corresponding information before the officer begins entering data. The mobile computing software provides officers in the field access to critical, accurate and real-time information.

WWW.NEWWORLDSYS.COM

OR 248-269-1000

Oscilloscope undergoes self-test



Model 5105A from **B+K Precision** is a 150MHz analog/digital storage oscilloscope. This benchtop unit incorporates a high-end digital scope with a 200MS/s sampling rate. On up-start the model automatically undergoes a diagnostic self-test to ensure proper operating conditions. A single button is used to switch from analog to digital storage operation. Autoset, a feature of the model, provides automatic setup of time base, vertical axis and trigger parameters of the signal being measured. The user can then readjust the time base and vertical axis as required. As many as 17 automatic measurements are displayed by readouts on the screen.

WWW.BKPRECISION.COM

Transceiver works with similar units

The UD-401 UHF transceiver module from **Ranger Communications** is optimized for data applications where high RF performance (such as European PTT standards) and small size are requirements. This module is footprint- and pin-compatible with other similar units in the market such as the Johnson 3474 transceiver module. This product covers the UHF 406MHz-512MHz band segments and is narrowband- (12.5KHz or 6.25KHz) capable. Attack times of less than 10ms, better than 1.5ppm frequency stability and low "key up" sideband noise ensure high throughput and stability.

WWW.RANGERUSA.COM

Cables offer triple-shielding system

Designed for operation to 18GHz or 40GHz, Testmate cables from **Times Microwave Systems** feature a proprietary triple-shielding system. Several designs feature interchangeable connector heads. Cable assemblies have

low attenuation, long-term electrical stability and are rugged enough for daily use in many applications.

WWW.TIMESMICROWAVE.COM



WHEN STABILITY COUNTS

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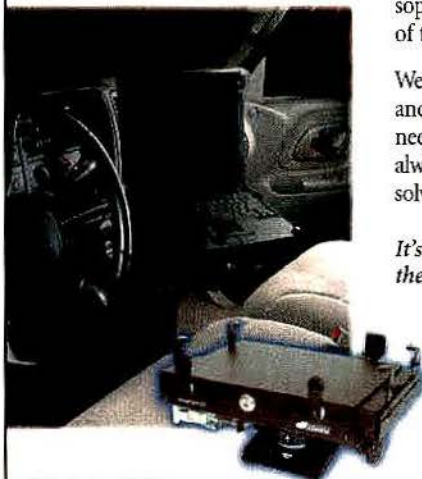
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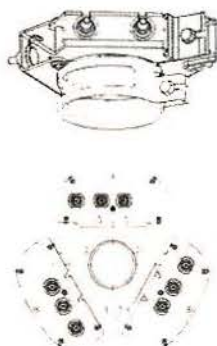
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CIRCLE (41) ON FAST FACT CARD

Hardware eliminates repeated adjustments

The ASB-3 mount from **Kathrein, Scala Division**, allows the system operator to mount three panel antennas on a single 4 1/2" mast. The complete assembly with antennas has a diameter of 18.1". When used with the XPV series antennas, a complete three-sector cross-polarized receive and vertical transmit system can be erected quickly and easily. Mechanical downtilt can be added as needed with only a small increase in diameter. The



mount consists of two hot-dipped, galvanized-steel three-sector clamps and two aluminum mounting support clamps. It includes all stainless steel assembly hardware. The mounting clamps support the assembly during azimuth adjustments and provide additional support after adjustments are complete. A single bolt on the sector clamp snugs the assembly to the mast, eliminating the repeated adjustments needed when multiple mounting arrangements for each antenna are used. All antenna mounting points are formed with keyed holes, allowing the supplied hardware to be blind-tightened.

WWW.KATHREIN.COM

Rack components offer larger sizes

Winsted's four rack modules are part of a comprehensive line of rack components. The models 84034 (19 3/8" D) and 86034 (26" D) are base/slope consoles with a 24 1/2-foot-high sloping top module designed to hold two sets of 9" monitors with 3 1/2" (2U) of added height to accommodate additional electronics. The models 86013 (22 5/8" D) and 84013 (16" D) rack modules are both 21" high (12U). They hold two sets of 9" monitors. The all-steel components come with removable punched rack rails.

WWW.WINSTED.COM

Antenna operates in 142MHz-164MHz

The TRA(B)420 from **Antenex** features a tuning inductor for simplified tuning through the band. This antenna operates within the 142MHz-164MHz frequency. The operating coverage is about 1MHz-1.5MHz. Installation can be performed without trimming a tuning disk. Simply adjust the tuning inductor.

WWW.ANTENEX.COM

Radio offers value-added security features

Not only does the SP-150V from **Topaz3** deliver LTR trunking and conventional two-way radio operation, but it also provides value-added security features. These features include password protection, which prevents unauthorized reprogramming of the radio, and embedded

messaging to aid in identifying the radio's owner if the unit is lost or stolen. Additional performance features include user scan-list editing, programmable audio levels and flash programming capability that allows quick, easy upgrades to its software.

WWW.TOPAZ3.COM

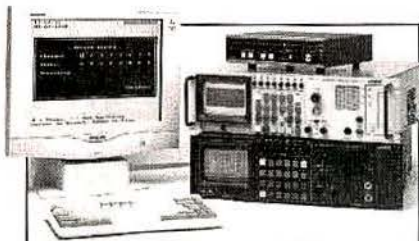


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The S-Series Repeater

Charger extends batteries life



JBRO Batteries'

Telepower Pro extends a battery's life as much as 10 years. Using a patented microprocessor, the charger removes and prevents memory effect, the number-one culprit for failed bat-

teries. Its four-stage charging cycle protects batteries, ensuring no overcharging, overheating or deep discharging. This product constantly monitors the battery and if it senses power loss, it will automatically restart the charge sequence, maintaining a fully charged battery for indefinite time periods.

WWW.JBRO.COM

Diagram determines contours

Hartech's wireless coverage diagrams are developed from electromagnetic field calculations to determine coverage contours. These contours can be placed over a variety of map formats to show the area covered by base, mobile and hand-held radios. This is presented directly on top of road maps or topographic maps using outlines, solids, cross hatches or plotted on transparencies as overlays for USGS or other maps. This product is customized for municipalities as well as private companies.

WWW.HARTECHINC.COM

Modem doubles transmit speed

The RF-5710A high-frequency modem from Harris transmits data at a rate of 19.2kbps, which doubles the current speed of 9,600bps. This product has been adopted by NATO and incorporates a broad range of interoperable waveforms, including STANAG 5066, 5065, 4529, 4481, 4415 and 4285. This product is also compliant with numerous military standards including MIL-STD-188-110A and MIL-STD-110B.

WWW.HARRIS.COM

Supplies offer lightweight design

The GXT 2U is a family of uninterruptible power supplies in 700VA, 1,000VA, 1,500VA, 2kVA and 3kVA sizes. These products from Liebert provide power protection, internal battery backup and an optional output distribution and maintenance bypass module, which is useful where space and uptime are critical. All features are packaged in a compact and lightweight design.

WWW.LIEBERT.COM



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345-375* MHz
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www.RELM.com

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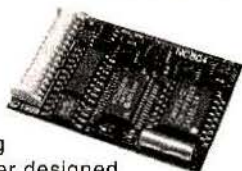
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Logger provides graphs, waveforms, reports



The single-phase power quality logger from **AEMC Instruments** is designed to measure and log from a complete suite of electrical and power quality parameters. This product measures, records and stores the selected parameters. The recorded information is retrieved via a computer using an RS-232 serial link. The report-

compliant Dataview Lite software package, which provides graphs, waveforms and pre-configured reports, is supplied with the loggers. The logger is designed for North American commercial, industrial and residential applications and is plugged into a standard ac receptacle. The logger is line-powered from the voltage source that it is connected to, with an internal battery to protect data integrity during power outages and programmed configuration for as long as one year.

WWW.AEMC.COM

Repeater/base station features DSP



The TKR-750/850 from **Kenwood Communications** has a rack-mount design with rear access to an external speaker output (four at audio), accessory/logic controller connector and test-speaker-AUX connector (15 pin). This product features wide/narrow channel spacing per channel and has programmable AUX input/output functions. It also offers DSP-processed QT/DQT and companded audio. The TKR-750 is a VHF model with 25W-50W adjustable

power. The TKR-850 UHF has 25W-40W adjustable power. This product is designed for small- to mid-size public safety agencies, local government, manufacturing and industrial plants, private security and construction. The repeater includes full-duplex operation and built-in QT/DQT community repeater operation with external controller interface. It is conventional- or trunking-controller compatible. The base station features 16-channel operation, simplex or full duplex operation, priority scan, remote control inputs and a two-digit LED channel and scan indicator.

WWW.KENWOOD.NET

Receptacle isolates ground signal

The RFB-1116-I-03, an isolated ground receptacle from **RF Connectors**, is useful in applications requiring insulation between the main connector body and the threaded mounting surface. This electrically isolates the ground signal of the circuit from the panel attachment. The circuit ground signal passes through the panel via the solder lug for termination inside a device or other grounding point. This product mates with any standard BNC plug and features



gold-plated contact, nickel-plated body and valox insulation.

WWW.RFINDUSTRIES.COM

WWW.MRTMAG.COM

Changing Channels



Broniman



Gurss

Appointments at Antenna Specialists, Cleveland, OH:

Carol Broniman heads the marketing department after working as product marketing manager. **Gregory G. Finn** joins the company as senior RF/antenna design engineer after designing printer systems and electronics for commercial and government applications. **Thomas L. Holman** departs Hy-Level Industries, Strongsville, OH, as quality assurance manager to join Antenna Specialists as quality assurance manager.

Appointments at the Land Mobile Communications Council:

Robert M. Gurss is elected president of the LMCC at the group's annual business meeting held April 20 in Washington. **Al Itner** is elected vice president. Directors-at-large include **Michele Farquhar**, **Thomas J. Keller** and **Paul B. Najarian**.

Amy McKennis, legislative assistant to Senator Fred Thompson, leaves to join the Cellular Telecommunications & Internet Association as a member of its congressional affairs team in Washington.

Lee W. Hogan joins Houston-based Crown Castle's board of directors after serving as vice chairman at Reliant Energy, Houston.

Carlos E. Pedraza leaves Marped, a distributor of Times cables in Latin America, to join the Times Microwave Systems sales team, Miami.

Jorgen Friis, vice president in the network division of Access, Tele, Denmark, is appointed deputy director general of the European Telecommunications Standards Institute.

Changes at Western Multiplex, Sunnyvale, CA:

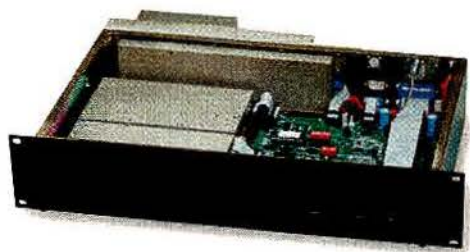
Rita Khayat-Toubia departs Hoechst Marion Roussel as director of global information systems controlling to join Western Multiplex as chief information officer. **Martin L. Christmas** leaves Shasta IP-Nortel Network as regional sales director to become vice president of Asia-Pacific sales.

Ed Phillips, Sheriff of Millard County, UT, wins the election for president of the Western States Sheriff's Association for 2001.

Jim Pratt, managing director for Telstra's international wireless operations, is elected deputy chair of the GSM Association.

Lori Slone, a 9-1-1 call-taker for the Guilford County (NC) Emergency Service Communications Division, gains the title "Hero" for National Public Safety Telecommunications Week sponsored by APCO.

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June

3-7: Supercomm, sponsored by TIA and USTA, Georgia World Congress Center, Atlanta. Contact: 800-278-7372.

11-12: AMTA's Annual Leadership Conference, sponsored by the American Mobile Telecommunications Association, Sheraton Suites, Alexandria, VA. 202-331-7773 or www.amtausa.org.

24-27: UTC Telecom, sponsored by UTC, the United Telecom Council, Midwest Express Center, Milwaukee. Contact: 202-857-1881 or www.utc.org.

24-28: NENA, sponsored by the National Emergency Number Association, Orlando, FL. www.nena9-1-1.org.

28: NPSPAC Region 24 800MHz Committee meeting, Missouri State Highway Patrol General Headquarters. Contact: Steve Devine, 573-526-6105.

July

15-18: Forestry Conservation Communications Association National Conference, Olympia, WA. www.mashell.com/~robblee/fcca.htm.

17-18: European Business Wireless Congress, sponsored by the International Wireless Telecommunications

Association, Prague. Contact: Ryan Cleveland, 202-331-7773.

August

5-9: Association of Public-Safety Communications Officials-International (APCO) National Conference, Salt Palace Convention Center, Salt Lake City. Contact: 904-322-2500 or www.apco-intl.org.

September

11-14: PCIA GlobalXChange, sponsored by the Personal Communications Industry Association, Los Angeles Convention Center, Los Angeles. Contact: 703-739-0300 or www.pcia.expoventure.com.

12-13: C.O.P.S. West, produced by the California Peace Officers' Association, Ontario Convention Center, Ontario, Canada. www.copswest.com.

19-22: Private Wireless Spectrum Management Conference & Expo, sponsored by Industrial Telecommunications Association, the Council of Independent Communications Suppliers and the USMSS, Grand Hyatt Hotel,

Washington. Contact: Ray Wisniewski at 703-528-5115 or email: ray@ita-relay.com.

November

6-8: Canadian Wireless, sponsored by the Canadian Wireless Telecommunications Association, Metro Toronto Convention Center, Toronto. Contact: 613-233-4888, ext. 102, or www.cwta.ca.

6-11: Communications Marketing Conference, DoubleTree Hotel Tucson-Reid Park, Tucson, AZ. www.commktga.com.

2002

March

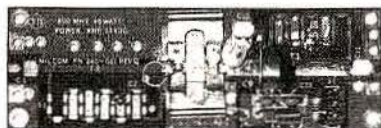
7-10: Entelec 2002, George R. Brown Convention Center, Houston. www.entelec.org.

April

24-26: International Wireless Communications Expo, co-sponsored by Mobile Radio Technology, Las Vegas Convention Center, Las Vegas. www.iwceconexpo.com.

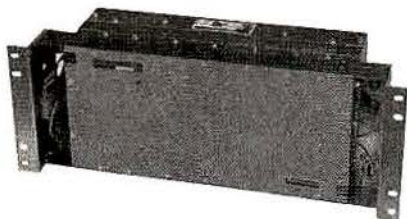
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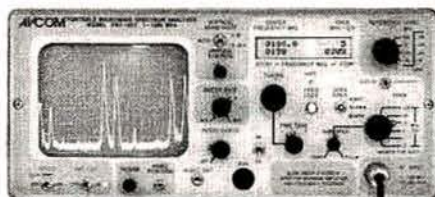


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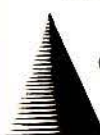


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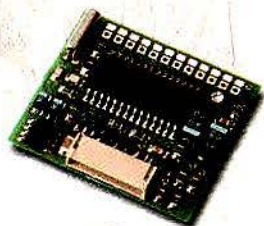
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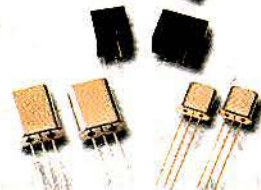


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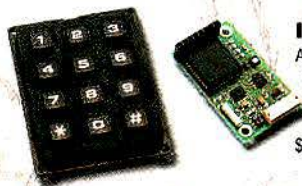
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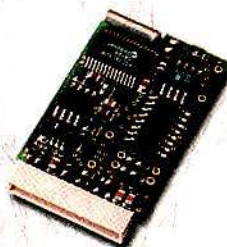
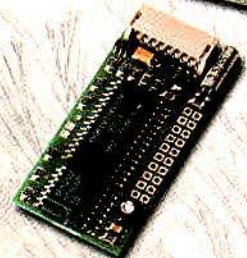
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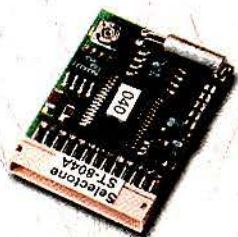
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